PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2001-101709

(43)Date of publication of application : 13.04.2001

(51)Int.Cl. G11B 7/24
G11B 7/0045

(21)Application number : 11-282387

(22)Date of filing : 04.10.1999

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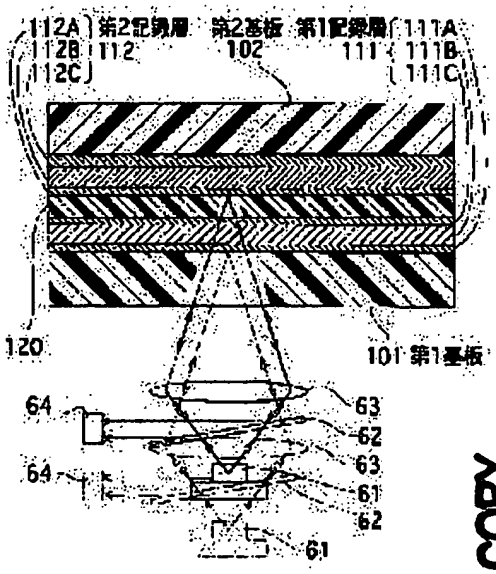
(54) OPTICAL RECORDING MEDIUM, OPTICAL RECORDING MEDIUM PRODUCING METHOD AND OPTICAL RECORDING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a DRAW type recording medium having two recording layers in which influences between the recording layers are eliminated and proper recording and reproducing can be performed, and to provide an optical recording medium producing method and an optical recording method.

SOLUTION: A first recording layer 111 having a structure consisting of, from the incident side of laser light, a first semireflection layer 111A, interference layer 111B and second semireflection layer 111C is formed on a first substrate 101. A second recording layer having a structure consisting of, from the incident side of laser light, a semireflection layer 112A, interference layer 112B and reflection layer 112C is formed on a second substrate 102. Then the substrates are laminated with the recording layers facing each other. The phase change of the transmitted light in the first recording layer 111 caused by recording in the first recording layer 111 is specified to ≤10° concerning to the wavelength of recording and reproducing light for the second recording layer 112.



LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] this invention -- the program of a computer etc. and data logging, and the optical recording medium further used for information records for entertainment, such as a still picture, an animation, and a sound, -- being related -- especially -- a record layer -- two-layer -- ****** -- it is related with the manufacture approach of the optical recording medium of a postscript mold, and an optical recording medium, and the optical recording approach.
[0002]
[Description of the Prior Art] The needs which record as much information as possible on a disk-like medium increase rapidly with development of an information industry, and the researches and developments for it are done briskly.
[0003] DVD(Digital Versatile Disk)-ROM only for playbacks can store much information from the optical disk which has the one-layer record layer represented with having a two-layer record layer etc. by the compact disk (CD). Therefore, DVD-ROM has spread quickly. On the other hand, the need of the medium in which mass writing is possible is also increasing. The two-layer record medium of current and a phase change mold is reported to the need (the collection p.1008 of the time [59th] Japan Society of Applied Physics scientific lecture-meeting lecture drafts of the 1998 autumn: Matsushita Electric Industrial).
[0004] On the other hand, the postscript record medium called the so-called DVD-R is put in practical use to the above-mentioned phase change mold two-layer medium. What used refractive-index change of organic coloring matter as a record principle is known by this DVD-R, and it is possible to write information in one place once. Since [that structure is simple and] initialization is unnecessary, it has potential possibility about low-cost-izing. However, since there is one record layer using this organic coloring matter, a raise in storage capacity is dramatically difficult.
[0005] The case where the above-mentioned DVD-R using organic coloring matter as a record layer is simply made two-layer here is considered. Drawing 13 is the outline sectional view having shown the layer system typically. Here, the graphic display of a groove is omitted.
[0006] It comes to form the 1st record layer 21, a glue line 30, and the 2nd record layer 22 sequentially from the 1st substrate 11 side whose optical recording medium 10 constituted as shown in drawing the 1st substrate 11 and the 2nd substrate 12 are arranged at parallel, and is a laser beam incidence side in the meantime. The information recorded on the 1st and 2nd record layers 21 and 22 carries out incidence of the laser beams 41 and 42 which carried out the focus to each record layers 21 and 22 from the 1st substrate 11 side, detects the reflected lights 51 and 52, and is read.
[0007]
[Problem(s) to be Solved by the Invention] However, in such a postscript mold optical recording medium 10 of two-layer structure, when it records on the 1st record layer 21, there is a problem that the record regenerative signal over the 2nd record layer 22 located in the back deteriorates. That is, it is because the transmitted light changes with object sexual change (refractive-index change in this case) of the 1st record layer produced by record of the information on the 1st record layer 21 between the Records Department of the 1st record layer 21, and the non-Records Department.
[0008] Let it be a technical problem to make this invention in view of an above-mentioned problem, to be the optical recording medium of the postscript mold which has a two-layer record layer, to eliminate the effect of [between each record layer], and to offer the manufacture approach of an optical recording medium and an optical recording medium and the optical recording approach of performing proper record playback.
[0009]
[Means for Solving the Problem] In solving the above technical problem, the optical recording medium concerning claim 1 of this invention It has the 1st record layer and the 2nd record layer, and the 1st record layer at least is a postscript mold among these 1st and 2nd record layers. By the optical exposure from the 1st record layer side It is

characterized by being the optical re[redacted]ding medium which write information to [redacted]st or 2nd record layer, and the phase change (absolute value) of the [redacted]nsmitted light of the 1st record layer produced by record of the 1st record layer about the record or the playback light wave length to the 2nd record layer being 10 or less degrees.
[0010] Moreover, it is characterized by the product (optical thickness) of the complex-index-of-refraction real part of a layer and thickness from which change produces substantially the optical recording medium concerning claim 2 of this invention by record of the above-mentioned 1st record layer about the record or the playback light wave length to the above-mentioned 2nd record layer being 0.02 or less times of the above-mentioned record or playback light wave length.
[0011] Furthermore, it is characterized by change of the product (optical distance) of the complex-index-of-refraction real part of the above-mentioned 1st record layer and thickness by record being 5nm or less about record or playback light wave length. [as opposed to the above-mentioned 2nd record layer in the optical recording medium concerning claim 3 of this invention]
[0012] It becomes it is possible to also constitute the above-mentioned 2nd record layer from a record layer of a postscript mold, and possible to realize the two-layer postscript mold record medium with which the writing of the information on the 2nd record layer located in a laser incidence back side by the writing to the 1st record layer located in a laser incidence side and read-out of that information are not checked with simple structure according to the optical recording medium which applies to above-mentioned claims 1-3 in this case.
[0013] Moreover, if the above-mentioned 2nd record layer is a record layer only for playbacks, it will become possible to obtain the two-layer postscript mold record medium with which read-out of the information recorded on the 2nd record layer located in a laser incidence back side by the writing to the 1st record layer located in a laser incidence side is not checked.
[0014] On the other hand, optically, on the 1st transparent substrate, the manufacture approach of the optical recording medium concerning claim 12 of this invention carries out the laminating of the 1st half-reflecting layer, an interference layer, and the 2nd half-reflecting layer to order, forms the 1st record layer, and is characterized by carrying out opposite arrangement of this 1st record layer of each other with the 2nd record layer formed at the 2nd substrate, and pasting up.
[0015] It enables this to manufacture the optical recording medium concerning claims 1-3 by the easy approach.
[0016] Moreover, the optical recording approach concerning claim 16 of this invention Information can be written in by the exposure of the laser beam for record from disk one side. It is the optical recording approach to an optical recording medium with the 1st and 2nd two-layer record layers. It is characterized by for the 1st record layer located in a laser beam incidence side carrying out the laminating of the 1st half-reflecting layer, an interference layer, and the 2nd half-reflecting layer to order, consisting of an optical incidence side, and recording by making the thickness of the 1st half-reflecting layer changing with the exposures of a laser beam.
[0017] The writing to the 1st record layer located in a laser incidence side can be performed without checking the writing of read-out of the information recorded on the 2nd record layer located in a laser incidence back side by this, or the information on the above-mentioned 2nd record layer, and read-out of the information.
[0018]
[Embodiment of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.
[0019] Drawing 1 shows the structure of the 1st record layer of the optical recording medium (optical disk) in the gestalt of operation of this invention. The 1st record layer 111 is a record layer of a postscript mold, and it comes to carry out laminating formation of 1st half-reflecting layer 111A, interference layer 111B, and the 2nd half-reflecting layer 111C on the 1st transparent substrate 101 at order more nearly optically than an optical incidence side. The 1st record layer 111 has the land which divides between the groove for guiding a laser beam, and a groove. A record pit is formed in a groove.
[0020] 1st half-reflecting layer 111A is explained.
[0021] 1st half-reflecting layer 111A has the thickness (optical thickness dopt) from which the optical distance which is the product of the complex-index-of-refraction real part and thickness becomes 0.02 or less times of record and playback light wave length. For example, 650nm When performing record playback with light, it sets thickness to d, setting complex-index-of-refraction real part of 1st half-reflecting layer 111A as n, and nxd should just be 13nm or less. Or 635nm It records with light and is 650nm. It is 635nm when reproducing with light. It sets and nxd is 12.7nm or less and 650nm. It sets and nxd should just be 13nm or less.
[0022] Moreover, 1st half-reflecting layer 111A reflects a part of irradiated laser beam, and has the property which penetrates a part. If the laser beam for record is irradiated, 1st half-reflecting layer 111A will deform (hole vacancy). Deformation here means the thing of change (reduction in thickness) of the thickness by migration of the matter which

constitutes the film, diffusion, etc.
[0023] As for 1st half-reflecting layer 111A, it is desirable for the melting point to consist of an ingredient which is below 500 ** extent more than 200 ** in order to make deformation easy. Moreover, as for 1st half-reflecting layer 111A, it is desirable to consist of matter which has a low refractive index in order to shorten the above-mentioned optical thickness. as the ingredient which has such a property -- Au-Si, Au-Sn, Au-Sb, Au-In, Au-Pb, Au-Sn-Ag, Au-Sn-Pb, Au-germanium, and Au-Ga etc. -- a gold alloy, Ag-Sb, Ag-In, Ag-Sn, Ag-aluminum, Ag-Pt, and Ag-Zn etc. -- a silver alloy is mentioned. By using such an ingredient, deformation of thickness by the exposure of record light becomes possible together with being 1/10 or less [of record playback wavelength] thinly.
[0024] Next, interference layer 111B is explained.
[0025] Interference layer 111B is transparent to record playback light. Moreover, interference layer 111B has the duty which separates 1st half-reflecting layer 111A and 2nd half-reflecting layer 111C. When the thickness of interference layer 111B forms a record pit, it is die length which the reflected light from this 1st half-reflecting layer 111A and 2nd half-reflecting layer 111C interferes, and is weakened mutually. Thereby, it produces and cheats out of a difference about the reflected light reinforcement between the Records Department of the 1st half-reflecting layer, and the non-Records Department, and read-out of record becomes possible.
[0026] As for interference layer 111B, it is desirable to consist of matter which change by record cannot produce easily. As an ingredient which has such a property, SiOx, MgO, ZnS and MgF2, ZnS-SiO2, Ta 2O5, TiOx, TiCl, Y2O3, ZnO, ZnSe, ZnTe, ZrO2, ZrTiO4, PbCl2, PbF2, PbO, Pr 6O11, Sb2O3, Sb2S3, Sc2O3, HfO2, In2O3, LaF3, La2O3, LiF, MgF2, MgO, and Na3 -- AlF6, NaF, 5NaF, and 3 -- the dielectric of AlF3, NdF3, Nd 2O3, AlF3 and aluminum 2O3, Bi2O3, CaF2, CdS, CeF3 and CeO2, and Gd2O3 grade is mentioned.
[0027] Next, 2nd half-reflecting layer 111C is explained.
[0028] In 2nd half-reflecting layer 111C, the deformation by record needs to hardly be generated. Only the 1st half-reflecting layer 111A can produce deformation, and cannot make 2nd half-reflecting layer 111C produce deformation by making the melting point of the ingredient of 2nd half-reflecting layer 111C higher than 1st half-reflecting layer 111A. Metal thin films, such as gold, silver, and aluminum, a dielectric multilayer, etc. are mentioned as such an ingredient.
[0029] Drawing 2 shows the structure of the 2nd record layer 112 of the optical recording medium in the gestalt of operation of this invention. The 2nd record layer 112 in the gestalt of this operation is formed as the 1st record layer 111 mentioned above and a record layer of the postscript mold which has similar structure.
[0030] As for the 2nd record layer 112, it comes to carry out laminating formation of reflecting layer 112C and interference layer 112B and the half-reflecting layer 112A at order on the 2nd substrate 102 with which the groove was formed beforehand. Incidence of record playback light is performed from the half-reflecting layer 112A side. In addition, a protective layer may be prepared between half-reflecting layer 112A and a glue line 120. Moreover, a record pit is formed in a groove.
[0031] Half-reflecting layer 112A is explained.
[0032] Half-reflecting layer 112A reflects a part of irradiated laser beam, and has the property which penetrates a part. If the laser beam for record is irradiated, half-reflecting layer 112A will deform (hole vacancy). The thing of change (reduction in thickness) of the thickness by migration of the matter which constitutes the film, diffusion, etc. is meant as deformation here like half-reflecting layer 111A in the above-mentioned 1st record layer 111.
[0033] As for half-reflecting layer 112A, it is desirable for the melting point to consist of an ingredient which is below 500 ** extent more than 200 ** in order to make deformation easy. as the ingredient which has such a property -- Au-Si, Au-Sn, Au-Sb, Au-In, Au-Pb, Au-Sn-Ag, Au-Sn-Pb, Au-germanium, and Au-Ga etc. -- a gold alloy, Ag-Sb, Ag-In, Ag-Sn, Ag-aluminum, Ag-Pt, and Ag-Zn etc. -- a silver alloy is mentioned. By using such an ingredient, deformation by the exposure of record light becomes possible.
[0034] If interference layer 112B is explained, it is transparent to record playback light. Moreover, interference layer 112B has the duty which separates half-reflecting layer 112A and reflecting layer 112C. When the thickness of interference layer 112B forms a record pit, it is die length which the reflected light from half-reflecting layer 112A and reflecting layer 112C interferes, and is weakened mutually.
[0035] As for interference layer 112B, it is desirable to consist of matter which change by record cannot produce easily. As an ingredient which has such a property, SiOx, MgO, ZnS and MgF2, ZnS-SiO2, Ta 2O5, TiOx, TiCl, Y2O3, ZnO, ZnSe, ZnTe, ZrO2, ZrTiO4, PbCl2, PbF2, PbO, Pr 6O11, Sb2O3, Sb2S3, Sc2O3, HfO2, In2O3, LaF3, La2O3, LiF, MgF2, MgO, and Na3 -- AlF6, NaF, 5NaF, and 3 -- the dielectric of AlF3, NdF3, Nd 2O3, AlF3 and aluminum 2O3, Bi2O3, CaF2, CdS, CeF3 and CeO2, and Gd2O3 grade is mentioned.
[0036] Reflecting layer 112C is larger than the thickness of 2nd half-reflecting layer 111C of the 1st record layer

mentioned above enough, and does [redacted]enetrate record playback light. As for m[redacted]eformation by record, in reflecting layer 112C, not accepting is desirab[redacted]nly half-reflecting layer 112A can produc[redacted]eformation, and cannot make reflecting layer 112C produce deformation by making the melting point of the ingredient of reflecting layer 112C higher than half-reflecting layer 112A. Metal thin films, such as gold, silver, and aluminum, a dielectric multilayer, etc. are mentioned as an ingredient suitable for reflecting layer 112C.

[0037] In the case of the structure shown above, pit formation according to record about the 1st record layer 111 is mainly thickness change of 1st half-reflecting layer 111A. Since the optical thickness before record is thin, 1st half-reflecting layer 111A has a small change of the optical thickness by record, and hardly produces the phase change of the transmitted light by record. Therefore, the phase of the transmitted light inside a pit is almost equal to the phase of the transmitted light of the perimeter of a pit, and it is possible to record on the 1st record layer 111, without disturbing the signal of the 2nd record layer 112 by the side of the back from the 1st record layer 111.

[0038] Therefore, according to the gestalt of this operation, it becomes possible to realize the two-layer postscript mold optical recording medium with which the writing of the information on the 2nd record layer 112 located in a laser incidence back side by the writing to the 1st record layer 111 located in a laser incidence side and read-out of the information are not checked with simple structure.

[0039] The informational writing and informational read-out device over the 1st and 2nd record layers 111 and 112 of the optical recording medium 100 constituted as mentioned above by drawing 3 are shown. Record playback of the information over an optical recording medium 100 is performed by irradiating a laser beam from the 1st substrate 101 side using the optical system equipped with the laser beam generating section 61, a half mirror 62, an objective lens 63, and the return photodetection section 64 so that it may illustrate.

[0040] By carrying out the focus of the laser beam for record generated from the laser beam generating section 61 with an objective lens 63 to up to 1st [of the 1st record layer 111] half-reflecting layer 111A, the writing of the information on the 1st record layer 111 decreases the thickness of the laser radiation part of the 1st half-reflecting layer 111A concerned, and forms a record pit. Moreover, by carrying out the focus of the laser beam for record to up to half-reflecting layer 112A of the 2nd record layer, the writing of the information on the 2nd record layer 112 decreases the thickness of the laser radiation part of the half-reflecting layer 112A concerned, and forms a record pit.

[0041] On the other hand, by carrying out the focus of the laser beam for playback generated from the laser beam generating section 61 to up to the 1st and 2nd record layer 111 and 112 with an objective lens 63, and detecting the return light in the return photodetection section 64 through a half mirror 62, read-out of the information written in the 1st and 2nd record layers 111 and 112 detects the reflected light reinforcement by the existence of a record pit, and reads information.

[0042]

[Example] Next, the following examples explain the manufacture approach of the optical recording medium constituted as mentioned above to a detail. in addition, the record playback light wave length in this example -- about 650nm it is .

[0043] (Example 1) 0.6mm in the diameter of 12cm, and thickness The groove/land for laser tracking were prepared in one field of the 1st substrate 101 made from a polycarbonate in the shape of a spiral. Here, it is 0.74 micrometers about the laser track pitch of a groove. Groove width of face / land-width ratio was set to 0.54, and the groove depth was set to 66nm.

[0044] On the other hand, the 2nd substrate 102 is 0.6mm in the diameter of 12cm, and thickness similarly. It considers as the product made from a polycarbonate, the groove/land for laser tracking are prepared in one field of this 2nd substrate 102 in the shape of a spiral, and it is 0.74 micrometers about the laser track pitch of a groove. Groove width of face / land-width ratio was set to 0.54, and the groove depth was set to 66nm.

[0045] The 1st record layer 111 which consists of the 1st half-reflecting layer 111A, interference layer 111B, and the 2nd half-reflecting layer 111C was formed as follows on the 1st substrate 101. here -- the 1st record layer 111 -- 9.7% of reflection factors, and 52.9% of permeability it was .

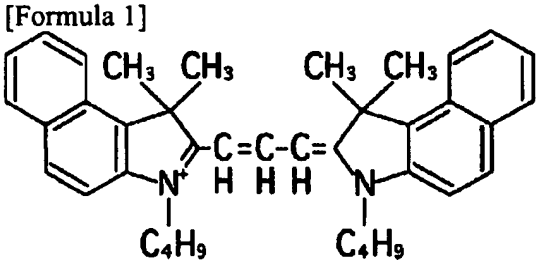
[0046] To the beginning, it is the wavelength of 650nm. It sets and is complex-index-of-refraction 0.388-2.96i. Au-Si of the weight ratio 94:6 which it has 1st half-reflecting layer 111A which consists of an alloy was formed by the spatter on the field in which the groove of the 1st substrate 101 was formed. Thickness could be 22nm. Au-Si of the weight ratio 94:6 The melting point of an alloy is 370 ** in the state of bulk. The optical thickness which is the product of complex-index-of-refraction real part and thickness is 8.5nm. They could be 0.02 or less times of record playback light wave length.

[0047] And the SiOx thin film was formed by the spatter on 1st above-mentioned half-reflecting layer 111A, and it was referred to as interference layer 111B. Thickness could be 102nm (= 0.26x record playback wavelength / complex-index-of-refraction real part). wavelength of 650nm of the formed film the complex index of refraction which can be set

-- 1.65-0.00i (= 1.65) it was .
[0048] Subsequently, it is the wavelength of 650nm on interference layer 111B. It sets and is complex-index-of-refraction 0.167-3.15i. The gold (Au) which it has was formed in 16nm of thickness by the spatter, and it was referred to as 2nd half-reflecting layer 111C. The golden melting point is 1063 degrees C in the state of bulk.
[0049] The 2nd record layer 112 which consists of half-reflecting layer 112A, interference layer 112B, and reflecting layer 112C was formed as follows on the 2nd substrate 102. The 2nd record layers were 50.8% of reflection factors, and 0.0% of permeability.
[0050] First, it is 200nm of thickness by the spatter on the field in which the groove of the 2nd substrate 102 was formed. The golden thin film was formed and this was set to reflecting layer 112C.
[0051] And it is 118nm of thickness by the spatter on above-mentioned reflecting layer 112C. MgF2 thin film was formed and this was set to interference layer 112B.
[0052] Subsequently, it is Au-Si (94:6) of 26nm of thickness on interference layer 112B by the spatter. The mixed thin film was formed and this was set to half-reflecting layer 112A.
[0053] opposite arrangement of the mutual record layers 111 and 112 is carried out inside, and the 1st substrate 101 and the 2nd substrate 102 which are constituted as mentioned above are shown in drawing 4 -- as -- record playback light -- setting -- 55**15 micrometers in a refractive index 1.55 and thickness the bright film (glue line) 120 which it has -- using -- a law -- lamination and an optical recording medium 100 were produced by the method.
[0054] (Examples 2-5) The optical recording medium 100 was produced on the conditions shown in a table 1 by the same technique as an example 1. They are 0.02 times (13nm) of record playback light wave length (about 650nm) about the optical thickness of 1st half-reflecting layer 111A [in / on which example and / the 1st record layer 111]. It is considering as the following.
[0055]
[A table 1]

実施例	1	2	3	4	5
第1記録層					
反射率	9.7%	14.2%	11.3%	8.9%	8.7%
透過率	52.9%	54.1%	61.4%	58.4%	55.6%
第1半反射層					
材料	Au-Si 94:6wt%	Au-Si 94:6wt%	Au-Si 94:6wt%	Au-Si 94:6wt%	Au-Si 94:6wt%
膜厚	22nm	24nm	24nm	24nm	24nm
光学的膜厚	8.5nm	9.3nm	9.3nm	9.3nm	9.3nm
干渉層					
材料	SiOx	MgF_2	ZnS	ZnS-SiO	Zn-Se
複素屈折率	1.65 -0.00i	1.38 -0.00i	2.30 -0.00i	2.10 -0.00i	2.57 -0.00i
膜厚	102nm (0.26w)	141.3nm (0.30w)	65.0nm (0.23w)	74.3nm (0.24w)	50.6nm (0.20w)
	wは媒質内での光の波長（650/屈折率）を示す				
第2半反射層					
材料	Au	Au	Au	Au	Au
膜厚	16nm	12nm	14nm	16nm	18nm

[0056] (Example of a comparison) The medium structure of the optical recording medium 200 in comparison with this example is shown in drawing 4 . The optical recording medium 200 in this example of a comparison has composition which stuck the 1st substrate 201 in which the 1st record layer 211 was formed, and the 2nd substrate 202 in which the 2nd record layer 212 was formed, by the glue line 220.
[0057] The 1st and 2nd substrate 201 and 202 is [both] 0.6mm in the diameter of 12cm, and thickness. It is a product made from a polycarbonate and the groove/land for laser tracking were prepared in the field of one of these in the shape of a spiral. Here, it is 0.74 micrometers about a laser track pitch. It is 150nm about 0.54 and the groove depth in groove width of face / land-width ratio. It carried out.
[0058] On the 1st substrate 201, the laminating of pigment layer 211A and the half-reflecting layer 211B was carried out one by one, and the 1st record layer 211 was formed. The procedure is as follows. First, it is 2000rpm about the tetrafluoro propanol 0.4% solution of the cyanine dye (Japanese sensitizing dye company make; NK-4288) shown by ** 1 on the 1st substrate 201. The spin coat was carried out and pigment layer 211A was formed. the thickness of pigment layer 211A -- the complex index of refraction of 80nm and coloring matter -- 2.1-0.11i it was . the optical thickness of pigment layer 211A -- 168nm it is . Next, the golden thin film with a thickness of 14nm was formed by the spatter on pigment layer 211A, and it was referred to as half-reflecting layer 211B. In this way, the obtained 1st record layer 211 is 13.8% of reflection factors, and 56.6% of permeability. It has.
[0059]
[Formula 1]



[0060] On the 2nd substrate 202, the laminating of reflecting layer 212B and the pigment layer 212A was carried out one by one, and the 2nd record layer 212 was formed. The procedure is as follows. First, the 95nm golden thin film was formed by the spatter on the 2nd substrate 202, and it was referred to as reflecting layer 212B. Next, it is the above-mentioned cyanine dye NK-4288 on reflecting layer 212B. It is 2000rpm about a tetrafluoro propanol 0.4% solution. The spin coat was carried out and pigment layer 212A was formed. In this way, the obtained 2nd record layer 212 has 51.3% of reflection factors, and 0.0% of permeability. And 1st substrate 212A and 2nd substrate 212B were stuck, and the optical recording medium 200 of this example of a comparison was produced.
[0061] The conditions shown below estimated the record reproducing characteristics of the optical recording medium of examples 1-5 and the example of a comparison.
[0062] - Record conditions (the 1st and 2nd record layer)
objective lens 63 NA=0.70 laser-diode wavelength 651.7nm luminous intensity Rad : 0.31Tan : 0.52 polarization condition: -- circular polarization of light linear velocity 1st record layer: -- 2nd record layer [of 3.49 m/s]: -- 1.75 m/s record signals: -- EFM+(date bit length=0.267micrometer) Write strategy:record power -- fixed -- system clock [, such as a control-system:focus, tracking, a spindle, and a slide,]:26.16MHz and, and playback conditions (the 1st and 2nd record layer)
objective lens NA=0.60 laser-diode wavelength 651.7nm luminous intensity Rad : 0.65Tan : 0.97 polarization condition: -- circular polarization of light linear velocity: -- 3.49 m/s laser power: -- 0.5mW control-system: -- a focus, tracking, a spindle, slide [0063], etc. The modulation factor of each optical recording medium of examples 1-5 and the example of a comparison is shown in drawing 5 - drawing 12 . A modulation factor is the reflection factor R1 before record here. Reflection factor R2 after the record when being referred to as 1 A changed part is meant and it becomes the relation of modulation factor = {1- (R2 / R1)}. R2 It is in the inclination to become small as record laser power becomes large (as for a record pit to become deep), therefore for a modulation factor to become large with lifting of record laser power. In addition, although the modulation factor of the 2nd record layer in examples 1-5 is in agreement by drawing 10 because the amount of transmitted lights of the 1st record layer 111 is almost equal to a top [**** / the 2nd record layer 112 / identically] between each example, a faint difference exists strictly.
[0064] Its attention is paid to the absolute value (cross talk) of a reflected light change of the 2nd record layer 112 by recording on the 1st record layer 111 on the strength at this time. This shows the rate of change of the reflected light

reinforcement of the playback light t[redacted]e 2nd record layer, or record light by rec[redacted]n the 1st record layer 111. At each example of this invention, it is a mo[redacted]tion factor 0.6. It sets and the same cross [redacted] has become 6.0% or more in the example of a comparison to a reflected light change (cross talk) of the 2nd record layer on the strength being less than 6.0%. In addition, it is a modulation factor 0.6 here. For having considered as criteria, the modulation factor in record pit die-length 14T (T: criteria die length) is 0.6. It is because the above is prescribed by current DVD specification.

[0065] Thus, according to the record medium of this invention, the cross talk between record layers is small, and it is possible to perform good record playback to the 2nd record layer 112.

[0066] Next, the phase change of the 1st record layer transmitted light by record of the 1st record layer in the optical recording medium of the examples 1-5 of this invention and the example of a comparison was evaluated. The result is shown in a table 2 - a table 7. In this example, it computed from the diaphragm structure of a record pit using the synthetic wave lining-up method which is a way method of multilayer approximation (it indicates to Mc Graw Hill, Inc.Optical Society ofAmerica Handbook of Optics, Second Edition, Vol.1, CHAPTER42, and OPTICAL PROPERTIES OF FILMS AND COATINGS). In addition, it sets for the example of a comparison and is the refractive-index real part of pigment layer 211A of before record / back 2.1/1.6 It carried out.

[0067]

[A table 2]

実施例1

	記録前	記録ピット（変調度約0.6(14T)）	位相差	光学的膜厚変化
第1半反射層膜厚	22nm	14nm		-3.1nm
干渉層膜厚	109nm	109nm		
第2半反射層膜厚	16nm	16nm		
透過光位相	-105.6度	-114.5度	-8.8度	

[0068]

[A table 3]

実施例2

	記録前	記録ピット（変調度約0.6(14T)）	位相差	光学的膜厚変化
第1半反射層膜厚	24nm	14nm		-3.9nm
干渉層膜厚	141.3nm	141.3nm		
第2半反射層膜厚	12nm	12nm		
透過光位相	-121.4度	-130.4度	-9.0度	

[0069]

[A table 4]

実施例3

	記録前	記録ピット（変調度約0.6(14T)）	位相差	光学的膜厚変化
第1半反射層膜厚	24nm	12nm		-4.7nm
干渉層膜厚	65nm	65nm		
第2半反射層膜厚	14nm	14nm		
透過光位相	-114.3度	-122.7度	-8.4度	

[0070]
[A table 5]
実施例4

	記録前	記録ピット（変調度約0.6(14T)）	位相差	光学的膜厚変化
第1半反射層膜厚	24nm	16nm		-3.1nm
干渉層膜厚	74.3nm	74.3nm		
第2半反射層膜厚	16nm	16nm		
透過光位相	-110.1度	-116.7度	-6.6度	

[0071]
[A table 6]
実施例5

	記録前	記録ピット（変調度約0.6(14T)）	位相差	光学的膜厚変化
第1半反射層膜厚	24nm	16nm		-3.1nm
干渉層膜厚	50.6nm	50.6nm		
第2半反射層膜厚	18nm	18nm		
透過光位相	-98.5度	-105.7度	-7.2度	

[0072]
[A table 7]

比較例

	記録前	記録ピット（変調度約0.6(14T)）	位相差	光学的膜厚変化
半反射層膜厚	14nm	14nm		
色素層膜厚	80nm	80nm		
色素層屈折率	2.1	1.6		-40nm
透過光位相	147.7 度	180.8度	33.1度	

[0073] Since the absolute value of the phase change of the transmitted light by record of the 1st record layer 111 is far small compared with 10 or less degrees and the example of a comparison according to this example as shown above, it contributes to low cross talk-ization mentioned above, and it becomes possible to carry out record playback, without disturbing record in the 2nd record layer 112 by record of the 1st record layer 111.
[0074] Moreover, according to this example, change of the optical thickness by record of the 1st record layer 111 compares with 5nm or less and the example of a comparison, and it is small (in the example of a comparison, although it is before and after record and there is no change of the substantial thickness of a record layer) far. If change of a refractive index is likened with change of thickness, it will become being set to about 40nm, and possible to carry out record playback, without disturbing record in the 2nd record layer 112 by record of the 1st record layer 111.
[0075] As mentioned above, of course based on the technical thought of this invention, various deformation is possible for this invention, although the gestalt and each example of operation of this invention were explained, without being limited to these.
[0076] For example, in the gestalt of the above operation, although the 2nd record layer 112 was formed as a record layer of a postscript mold, this may be formed by the ROM type only for playbacks. In this case, it becomes possible to reproduce information faithfully (read-out), without disturbing the playback light to the 2nd record layer by record of the 1st record layer. Moreover, the above-mentioned 2nd record layer may be constituted as a record layer of the postscript mold which has other medium structures.
[0077] Moreover, the 1st record layer is related with the record or the playback light wave length to the 2nd record layer irrespective of above-mentioned medium structure. [whether the phase change of the transmitted light of the 1st record layer produced by record of the 1st record layer is 10 or less degrees or change of the optical thickness of the 1st record layer by record is 5nm or less, and] Or all the 1st record layers of the postscript mold which the optical distance of the layer which change produces substantially by record of the 1st record layer is 0.02 or less times of the above-mentioned record or playback light wave length, and has the medium structure where the effectiveness mentioned above is acquired are in the applicability of this invention.
[0078]
[Effect of the Invention] According to this invention, the following effectiveness can be acquired as stated above.
[0079] That is, it becomes possible to realize the two-layer postscript mold record medium with which the writing of the information on the 2nd record layer located in a laser incidence back side by the writing to the 1st record layer which is located in a laser incidence side from claim 1 of this invention according to the optical recording medium according to claim 3, and read-out of the information are not checked.
[0080] Moreover, according to invention of claim 4 to claim 7, it becomes possible to realize the above-mentioned optical recording medium with simple structure, and it becomes possible to offer the optical recording medium of high capacity by low cost.
[0081] On the other hand, according to the manufacture approach of the optical recording medium of this invention according to claim 12, it becomes possible to manufacture the optical recording medium concerning claim 3 by the easy approach from claim 1 mentioned above, and it becomes possible to contribute to reduction of a manufacturing cost.
[0082] Furthermore, it becomes possible to perform the writing to the 1st record layer located in a laser incidence side, without checking the writing of read-out of the information recorded on the 2nd record layer located in a laser incidence back side, or the information on the above-mentioned 2nd record layer, and read-out of the information according to the optical recording approach of this invention according to claim 16.

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